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**4<sup>th</sup> meeting of the IGU WOC 5**  
**Study Group 5.3 – Natural Gas Vehicles (GNV)**  
**Penang, Malaysia, 21<sup>st</sup> – 22<sup>nd</sup> February 2008**

# Real life experiences from large fleets operators using NGVs

⊞ **Paris & Lille two study cases in France** ⊞

DIRECTION DE LA RECHERCHE

Direction des Programmes Développement

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# AGENDA

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1. DATA ON THE FRENCH ROAD-TRANSPORT MARKET
2. NGV CONTEXT IN EUROPE AND IN FRANCE
3. THE FRENCH NGV MARKET HISTORY...FROM BUSES TO PASSENGER CARS
4. FIGURES ON THE NGV MARKET IN FRANCE
5. FIRST EXAMPLE OF LARGE NGVs FLEET - THE CITY OF PARIS - KEYS OF SUCCESS
6. SECOND EXAMPLE – NGV BUSES IN LILLE – FROM BIOGAS PRODUCTION TO PASSENGERS TRANSPORTATION

# DATA ON THE FRENCH ROAD-TRANSPORT MARKET

- In France the entire road-transport market represents
  - ❖ Private Vehicles : 30 million
    - new vehicles market = 2 million/yr
    - used vehicles market = 5 million/yr
  - ❖ Light Duty Vehicles : 5 million
    - new vehicles market = 500 000/yr
    - used vehicles market = 750 000/yr
  - ❖ Buses : 25 000
    - replacement rate of 33%/yr
  - ❖ Wastes collecting trucks : 15 000
- If all of them were NGVs, it would represent a market of
  - ❖ **40 Mtep or 450 TWh**

# NGV CONTEXT IN EUROPE AND IN FRANCE

## European context, favorable to NGV/Bio-NGV

- ❖ Europe strengthens its position on the CO<sub>2</sub> emissions reduction
- ❖ NGV maintains its development in Italy and Germany
- ❖ Norms Euro 5 & Euro 6 have been published (favorable to diesel)
- ❖ NGV maintained in the 2<sup>nd</sup> call for projects of the FP7 programme

## France struggles to position itself on NGV: support or reject?

- ❖ No specific considerations to NGV in the conclusions of the "Grenelle de l'environnement" published in October 2007
- ❖ A bonus/malus system more favorable to diesel than to NGV
- ❖ The "TICGN" (Internal Tax on Natural Gas as a Fuel) is now nil
- ❖ NGV public station opened in a supermarket in Toulouse, but the effort has to be maintained
- ❖ Some encouraging experiments on the professional markets
- ❖ Some new developments on the biogas/bio-NGV in France

# THE FRENCH NGV MARKET HISTORY...FROM BUSES TO PASSENGER CARS

Public transportation

- 1996



NGV in the city

- 2002/2004



Domestic NGV

- 2004/2008



NGV deployment?

- 2008...



# FIGURES ON THE NGV MARKET IN FRANCE

## NGV in the city

NGV Buses : 2000

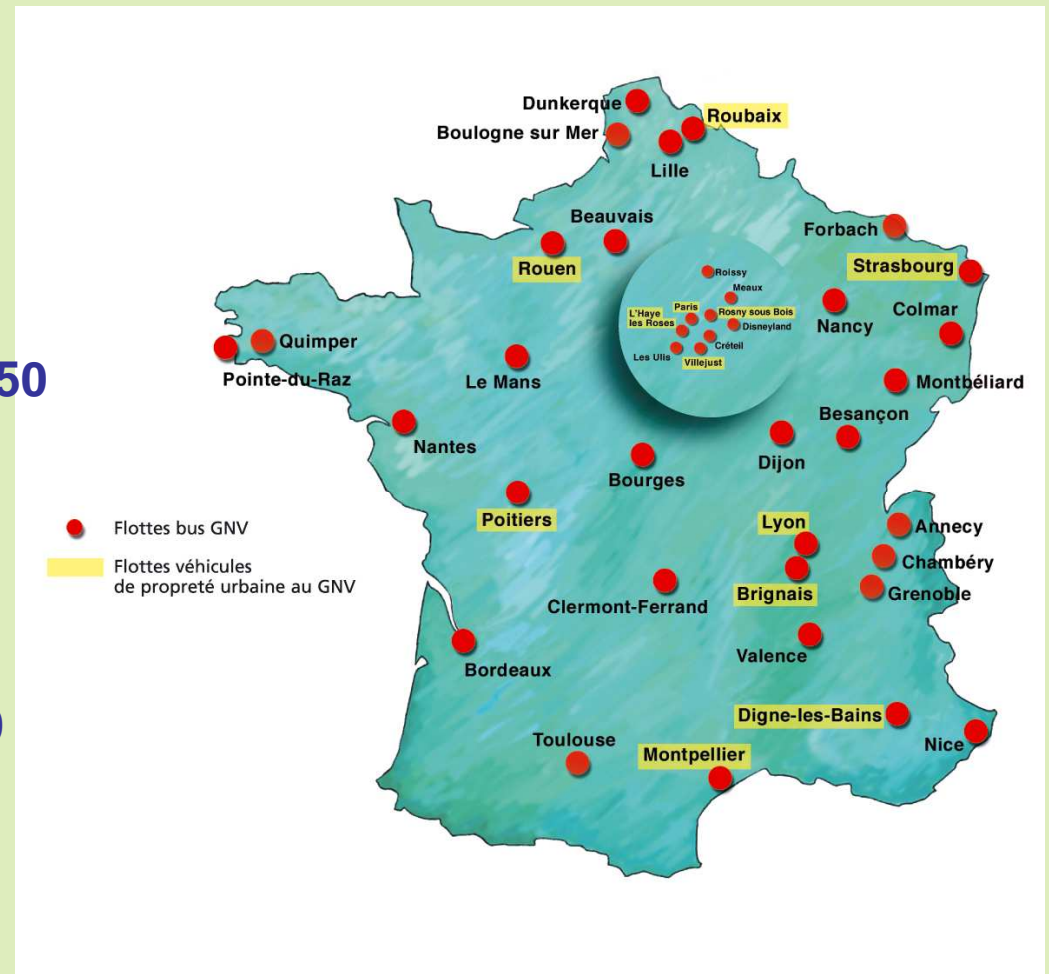
= 1/3 of renewals

NGV wastes collecting trucks : 750

NGV city-cleaning vehicles : 60

NGV company cars : 5500

Private refuelling stations : ~ 100





# **FIRST EXAMPLE OF LARGE NGVs FLEETS - THE CITY OF PARIS - WASTES COLLECTING TRUCKS FLEET KEYS OF SUCCESS**

From a presentation by Michel BINUTTI,  
Direction of the Environment Protection, City of Paris

# THE NGV CHOICE

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## Some politics orientations

### ❖ The Objectives

- ✓ To do better than the specifications mentioned in the law on air (law of the 31/12/96 : 20% of the renewals of vehicles <3.5 t by “clean” vehicles)
- ✓ Paris has to be taken as an example !

### ❖ The Order

- ✓ From 1997 to 2001 : 30% of the renewed vehicles are based on “clean” technologies
- ✓ Since 2001 : 100% of the renewed wastes collecting vehicles are NGVs.



# THE NGV CHOICE

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## Why NGV?

### ❖ **Technical reasons**

- ✓ No LPG offers from manufacturers on this market
- ✓ No constrain (compared to EVs)
- ✓ Larger autonomy of NGVs compared to EVs
- ✓ Possibility of fast refueling

### ❖ **Environmental reasons**

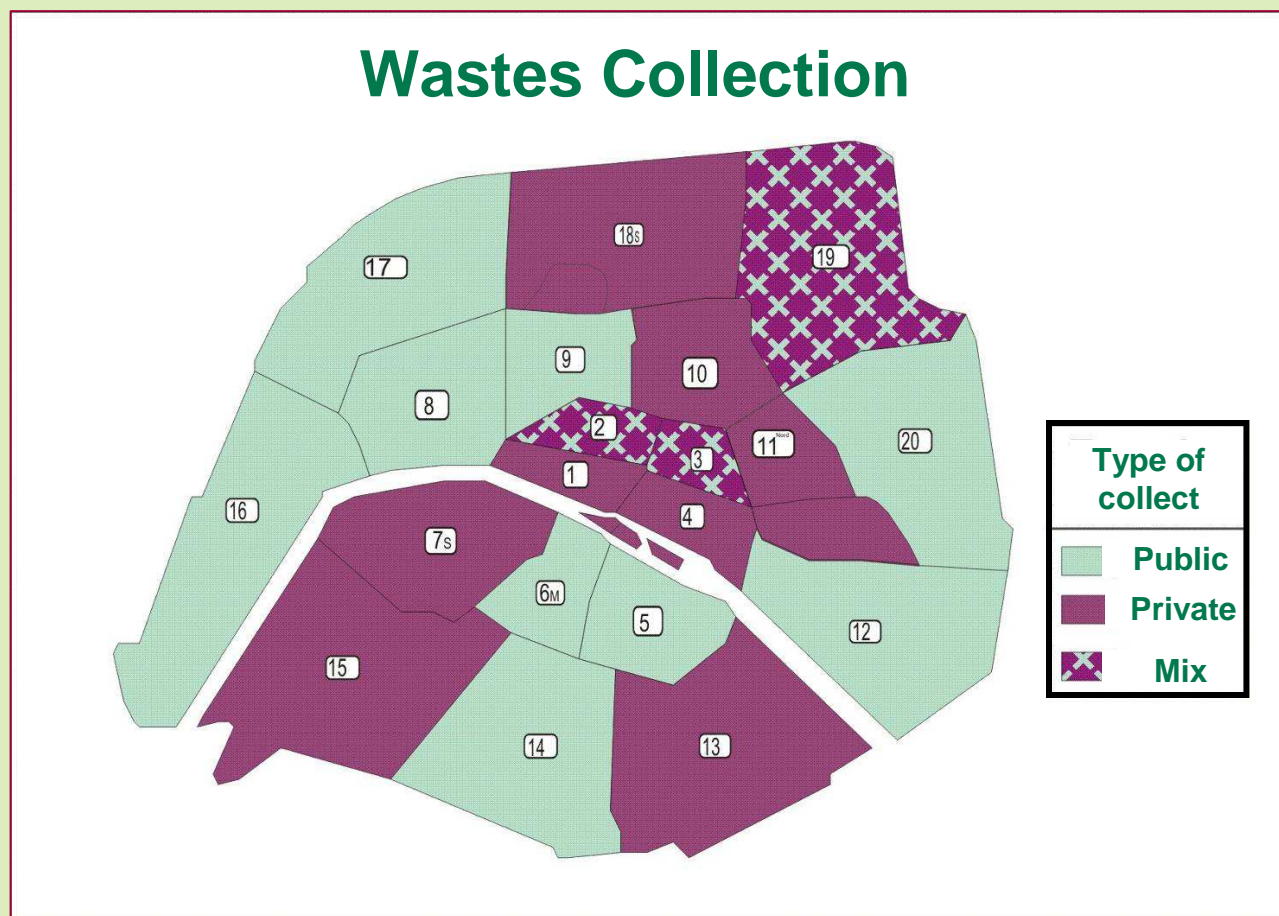
- ✓ No toxic emissions such as lead, sulfur or particles
- ✓ Energetic diversification

### ❖ **Financial objectives**

- ✓ Cost of consumption inferior or equal to the cost of diesel vehicles

# THE WASTES COLLECTION ORGANIZATION IN PARIS

- An equilibrium between private/public networks



# THE FLEET DEVELOPMENT

- A/ Purchase of NG powered wastes collecting trucks by the City of Paris
- B/ Adaptation of the trucks stations/garages
- C/ Supply of the NG (distribution points)



# THE FLEET DEVELOPMENT

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- Purchase of NG powered wastes collecting trucks by the City of Paris
  - ✓ 2002: 28 wastes collecting trucks
  - ✓ 2004: 90 wastes collecting vehicles + 17 streets-cleaning vehicles
  - ✓ 2005: 104 wastes collecting vehicles + 34 streets-cleaning vehicles
  - ✓ 2006: 26 wastes collecting vehicles + 5 streets-cleaning vehicles
  - ✓ 2007: 14 streets-cleaning vehicles
  
- Advantages
  - ✓ Potential increase of the commands for the vehicles manufacturers
  - ✓ Access to a network for the neighbouring cities

# ADAPTATION OF THE TRUCKS STATIONS/GARAGES

## Some difficulties encountered with the first garage (Ivry)

### ✓ Environmental aspects:

- Urban area
- Commercial area at proximity
- Residential area

### ✓ Administrative aspects

- Security study necessary
- Security wall construction
- Area limitations
- File instruction by authorities

## Other garages examples (Aubervilliers, Romainville)

- ✓ Easy external parking for all NGV trucks
- ✓ Adapted maintenance station in Romainville

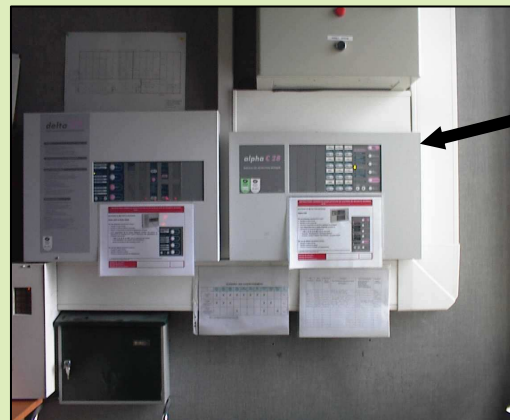


# ADAPTATION OF THE TRUCKS STATIONS/GARAGES

- Security in the NGV wastes collecting trucks garages
  - ✓ Secured lighting
  - ✓ Natural and mechanical gas evacuation
  - ✓ Gas detection system
  - ✓ Fire detection system adapted/upgraded



Evacuation on the roof



Gas detection and alarm system in the offices.

# SUPPLY OF THE NG – DISTRIBUTION POINTS

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## 3 steps in the process

- 1/ Demonstration plant in Ivry with a NGV distribution station
- 2/ Call for offers following the defined specifications
- 3/ Construction of 2 NGV distribution stations



# SUPPLY OF THE NG – DISTRIBUTION POINTS

- Construction and operation of the NGV distribution point in Ivry
  - ✓ Entrust to GNVert
  - ✓ Flow: 10 vehicles/hour
  - ✓ Fast filling points:  $>60 \text{ m}^3$  (n) in 5 min
- Call for offers and specifications
  - ✓ The objective being to find an external partner able to supply NG in the defined area to fill the vehicles of the City of Paris
  - ✓ Some obligations have been defined for such supplier:
    - To provide the field/place for the refueling NGV station
    - To build the station
    - To distribute the fuel in the scope of the market and eventually to other customers
    - Provide fuel to the vehicles of the City of Paris from both sites
    - To set up a computer assisted fuel distribution



# SUPPLY OF THE NG – DISTRIBUTION POINTS

## Results from the call

- ✓ Contract signed for 4 years between the City of Paris and GNVert (up to mid-2008)
- ✓ 2 NGV distribution stations built and operated:
  - Noisy-le-Sec
  - Saint-Denis



# SUMMARY AND CONCLUSIONS

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- For the waste collecting trucks operating companies
  - ✓ Since 2005 and up to 2009, obligation to use NGV trucks for collecting wastes within Paris
  - ✓ Obligation to comply with Euro 3 norms
  - ✓ Possibility to access to 3 distribution points (Ivry, Saint-Denis, Noisy-Le-Sec)
- For the distribution aspects
  - ✓ Some failures/cut of supply registered at the beginning due to losses of pressure or failures of the security system.
  - ✓ Mean refueling time: 3 minutes with a flow of 15 m<sup>3</sup> (n)/min
  - ✓ Mean time spent at the refueling station: 5 minutes

# SUMMARY AND CONCLUSIONS

## For the NGV aspects

- ✓ Mean consumption measured on a 19t vehicle:

10-12 m<sup>3</sup> (n)/100km which corresponds to 12,5-15,0 liter/100 km (?)

## Perspectives in 2008 for the City of Paris



	Public	Private	Total
Waste collecting trucks	197	228	425
Cleaning vehicles	53	24	77
Other GNV City vehicles	0	9	9
TOTAL	250	261	511

# KEYS OF SUCCESS

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- The politic decisions
- The adaptation/upgrade of the trucks station/garage is a strong constrain due to security aspects
- Need to support/form the technical employees in charge of driving the trucks and the maintenance teams
- Gas supply has to be entrusted to specialists
- Financial support from state/local authorities

# SECOND EXAMPLE OF LARGE NGVs FLEETS

## - NGV BUSES IN LILLE-

# FROM BIOGAS PRODUCTION TO PASSENGERS TRANSPORTATION



From a presentation by Christian Bleux,

Direction Bus de Transpole, Lille

# CHARACTERISTICS FROM LILLE URBAN COMMUNITY

- Since 1998, each purchased bus is a NGV bus
- Today, ~214 buses are NGV buses out of 330 buses running in Lille urban community. The objective is to have 100% buses running on gas/biogas.
- Lille is planning to fuel the NGV buses with the biogas produced
- In the urban community, 3 bus stations/garages have been created or upgraded (2 operating creations since 2007)
- Each bus station/garage is equipped with a pressurizing unit to feed the fleets (slow fueling stations)
- The situation in Lille urban community is the following:

	End 2007	End 2008
<b>Number of NGV buses</b>	<b>260</b>	<b>295</b>
<b>Number of kilometers made by these buses</b>	<b>~9,500,000</b>	<b>~12,500,000</b>

# THE BIOGAS BENEFITS

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- Since September 2007, an organic wastes valorization center is operational in Lille-Sequedin.
- 108,600 tons of organic wastes from cooking, gardening or domestic habits are converted into biogas.
- 4 million m<sup>3</sup> of biogas-fuel are produced, equivalent to 4 million liters of diesel fuel.
- The organic wastes valorization center provides fuel to 150 NGV buses for an operating cost similar to diesel-fueled buses.
- For the moment, NGV buses are fed directly from the wastes valorization center but in the future, the objective is to inject the purified biogas into the existing gas distribution lines (authorizations are under discussion with administrations)

# GENERAL FEEDBACKS

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- The use of NGV and especially biogas shows a real potential:
  - On economics aspects
  - Reliability
  - Environmental aspects (emissions, noise)
  - Security
- The higher purchasing cost for NGV is balanced by lower fuel costs by comparison to diesel fuel.
- NGV-related costs could be stabilized by working on optimizing the replacement parts costs and their reliability.
- Biogas incorporation brings environmental benefits to NGV in general which is already on an environmental point of view, more friendly than diesel.



## ECONOMICAL ASPECTS

- Comparison of the costs between Diesel/NGV on a 600,000 km basis

	Diesel	NGV	Difference
Purchasing cost	209 k€	244 k€	+35 k€
Fuel	249 k€	126 k€	-123 k€
Maintenance costs	156 k€	238 k€	+82 k€
TOTAL			-6 k€

- Maintenance costs include:
  - Security control visit (detailed inspection control)
  - NGV pressurizing station maintenance
  - Catalytic exhaust
  - Additional cost for NGV-specific pieces

# ENVIRONMENTAL ASPECTS

## Emissions controls recorded on 3 types of NGV buses

	AGORA					CITELIS
Date (mois/année)	05/99	05/99	10/03	10/03	01/05	01/07
Km véhiculé	16 500	16 500	80 000	80 000	133 000	45500
Numéro bus	10005	10005	10071	10071	10071	10153
Type de gaz	Gaz « B »	Gaz « Marquette »	Gaz « B »	Gaz « Marquette »	Gaz « B »	Gaz « B »
CO g/km	6.51	5.92	0.12	0.07	1.16*	0,85
NOX g/km	12.52	5.37	22.59	8.34	23.19	1,60
HC totaux g/km	14.73	14.63	4.94	12.5	10.52	0,10
HC Méthan. g/km	14.07	14.55	4.88	12.43	10.27	
CO g/km	1670	1697	1504	1514	1540	1473
Consommation Nm <sup>3</sup> /100 Débitmètre massique	87.31	90.55	83	86.8	87.7	83,4
Puissance max. à la jante	98.6 Kw à 2000 T/mn	94.1 Kw à 1800 T/mn	107.7 Kw à 1700 T/mn	95.7 Kw à 1600 T/mn	108.1 Kw à 1700 T/mn	113,9 Kw 1600 T/mn
Puissance corrigée à 2000 T/mn			102.5 Kw à 2000 T/mn			
Bruit	Gasoil 99 84 db		GNV 99 78 db	GNV 03 73 db	GNV 06 69 db	

# CONCLUSIONS

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- Lille urban community is very pro-active in France for the NGV market.
- Combination of NGV buses fleet + biogas production site is an operational equation.
- Introduction of biogas into the NGV chain brings a better solution than pure NGV solution on environmental aspects.
- Whatever the fuel used (NG or biogas) the interest of a NGV buses fleet has been demonstrated (lower costs, better reliability of the vehicles, more friendly for environment, etc.)

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# THANK YOU FOR YOUR ATTENTION

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# NGV, A NEW MARKET TO INCREASE THE GAS SALES

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❖ 1 automotive NGV  $\Leftrightarrow$  1 detached house  
 $\Leftrightarrow$  3-bedroom flat heated with NG  
= 10 MWh per year

❖ 1 heavy truck NGV  $\Leftrightarrow$  8-floor building  
 $\Leftrightarrow$  25 3-bedroom apartments)  
= 250MWh per year